

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE MODULE: Introduction to Non-Traditional Machining

Course Coordinator: Mr. Sukruth Sagar				Academic Year: 2026-27	
Department: Mechanical Engineering					
Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours	Total Hrs/ Sessions
				L:T: P:S	
BME755A	Introduction to Non-Traditional Machining	Elective	-	3:0:0:0	40

Course Learning Objective:

The course will enable the students to:

1. To learn various concepts related to modern machining processes & their applications.
2. To appreciate the differences between conventional and non-conventional machining processes.
3. To acquire a functional understanding of non-traditional manufacturing equipment.
4. To know about various process parameters and their influence on performance and their applications.
5. To impart knowledge on various types of energy involved in non-traditional machining processes.

Teaching-Learning Process (General Instruction):

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Adopt flipped classroom teaching method.
4. Adopt collaborative (Group Learning) learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.

Module-1

Introduction to Non-traditional machining. Need for Non-traditional machining process, comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

TLP: Power Point Presentation, Video demonstration or simulations, Chalk and Talk

Module-2

Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM.

Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics- Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.

TLP: Power Point Presentation, Video demonstration or simulations, Chalk and Talk

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Module-3

Electrochemical Machining (ECM): Introduction, Principle of electro chemical machining, ECM, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish. Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials. Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH.

Chemical Machining (CHM): Elements of the process, Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.

TLP: Power Point Presentation, Video demonstration or simulations, Chalk and Talk.

Module-4

Electrical Discharge Machining (EDM): Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system.

Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM.

Plasma Arc Machining (PAM): Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety precautions, applications, advantages and limitations.

TLP: Power Point Presentation, Video demonstration or simulations, Chalk and Talk.

Module-5

Laser Beam Machining (LBM): Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations.

Electron Beam Machining (EBM): Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.

TLP: Power Point Presentation, Video demonstration or simulations, Chalk and Talk.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe non-traditional machining process and **compare** with traditional machining process.

Recognize the need for Non-traditional machining process. **(L3)**

CO2: Describe the constructional features, performance parameters, process characteristics, applications, advantages, and limitations of USM, AJM and WJM. **(L3)**

CO3: Characterize the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages, and

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limitations. (L3)

CO4: Illustrate the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM (L3)

CO5: Elucidate the LBM equipment, LBM parameters, and characteristics. **Describe** EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM. (L3)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

- At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the

CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be reduced proportionally to 50 marks

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books

- 1 Modern Machining Process by P.C Pandey and H S Shah McGraw Hill Education India Pvt. Ltd. 2000
- 2 Production technology HMT McGraw Hill Education India Pvt. Ltd 2001

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Reference Books

- 1 New Technology Dr. Amitabh Bhattacharyya the Institute of Engineers (India) 2000
- 2 Modern Machining process Aditya 2002

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Subject Code: BME755A				TITLE: Introduction to Non-Traditional Machining					Faculty:			
List of Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	3	-	-	-	-	-	-	-	-	2	2
CO-2	2	3	-	-	-	-	3	-	-	-	2	2
CO-3	2	3	-	-	-	-	3	-	-	-	2	2
CO-4	2	3	-	-	-	-	3	-	-	-	2	2
CO-5	2	3	-	-	-	-	3	-	-	-	2	2

Note: 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution - = No Contribution